V. Bellini and R. Potenza

Possible contribution of Catania Group to Homestake DUSEL Program

1) Participation to the realization of the detector for long baseline neutrinos from Fermilab;

2) Contributions to measurements of the nuclear matrix elements relevant in obtaining neutrino mass from double beta decay lifetimes.

LNS in numbers

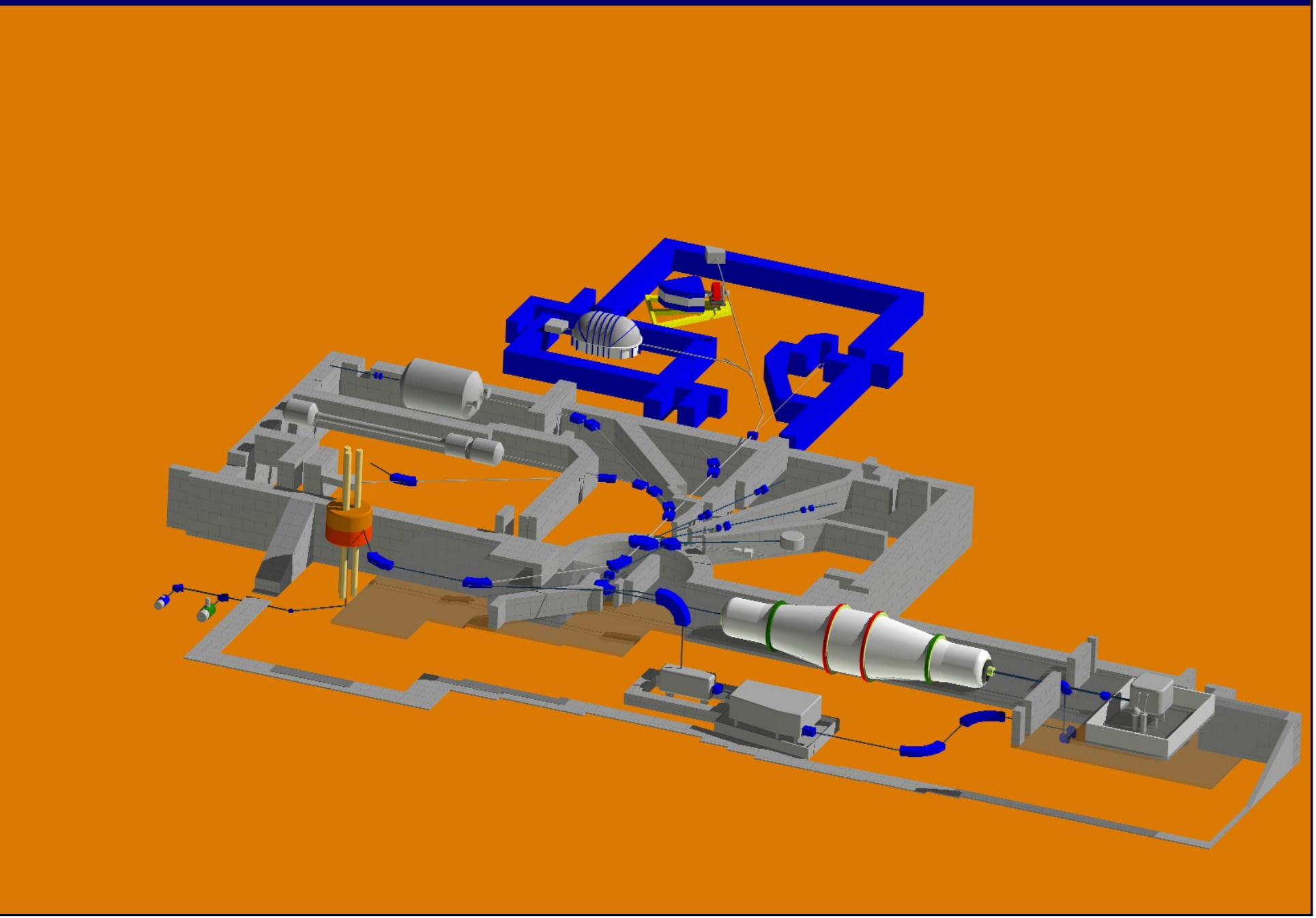
INFN Laboratori Nazionali del Sud are located in the Catania University campus area

- ***Total area: 35000 m^2***
- ***Total volume: 97000 m^3***

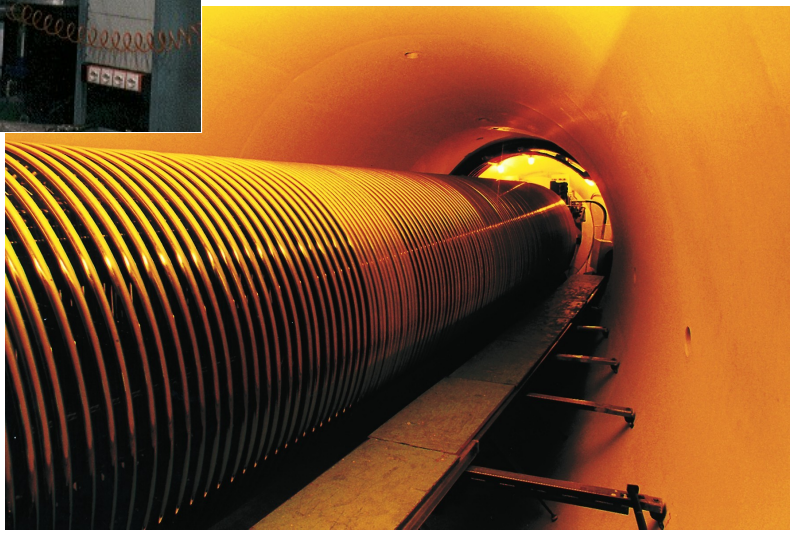
- ***Staff members: 110***
- ***Associated researchers: 80***
- ***Users: 250***
- ***Foreign users: 150***
- ***Annual scientific production:***

  about 150 (papers and proceedings)
- ***Budget: about 11 MEuro/year***

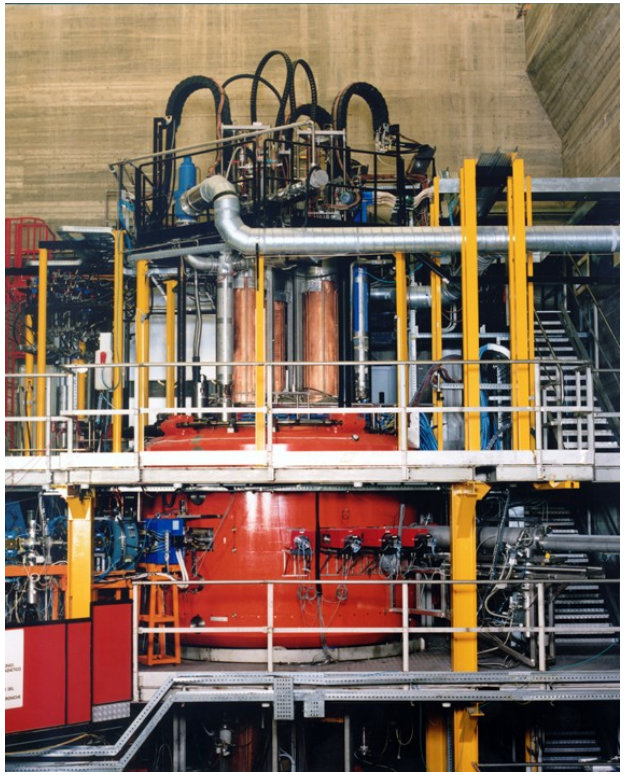
LNS lay-out



The Tandem accelerator



The Superconducting Cyclotron

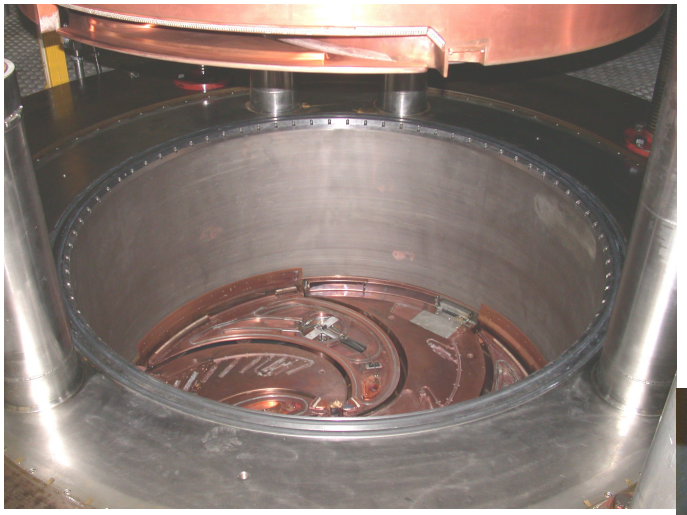


$(T/A)_{max} = K_{bending} (Q/A)^2 \sim 25$ AMeV

^{197}Au

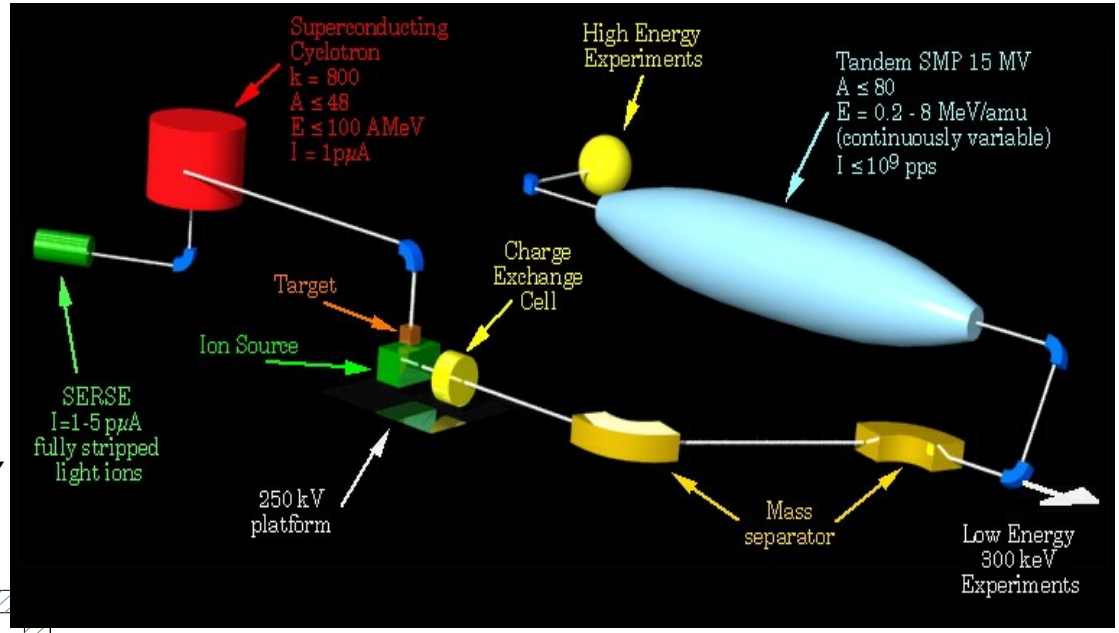
$(T/A)_{max} = K_{focusing} (Q/A) = 100$ AMeV

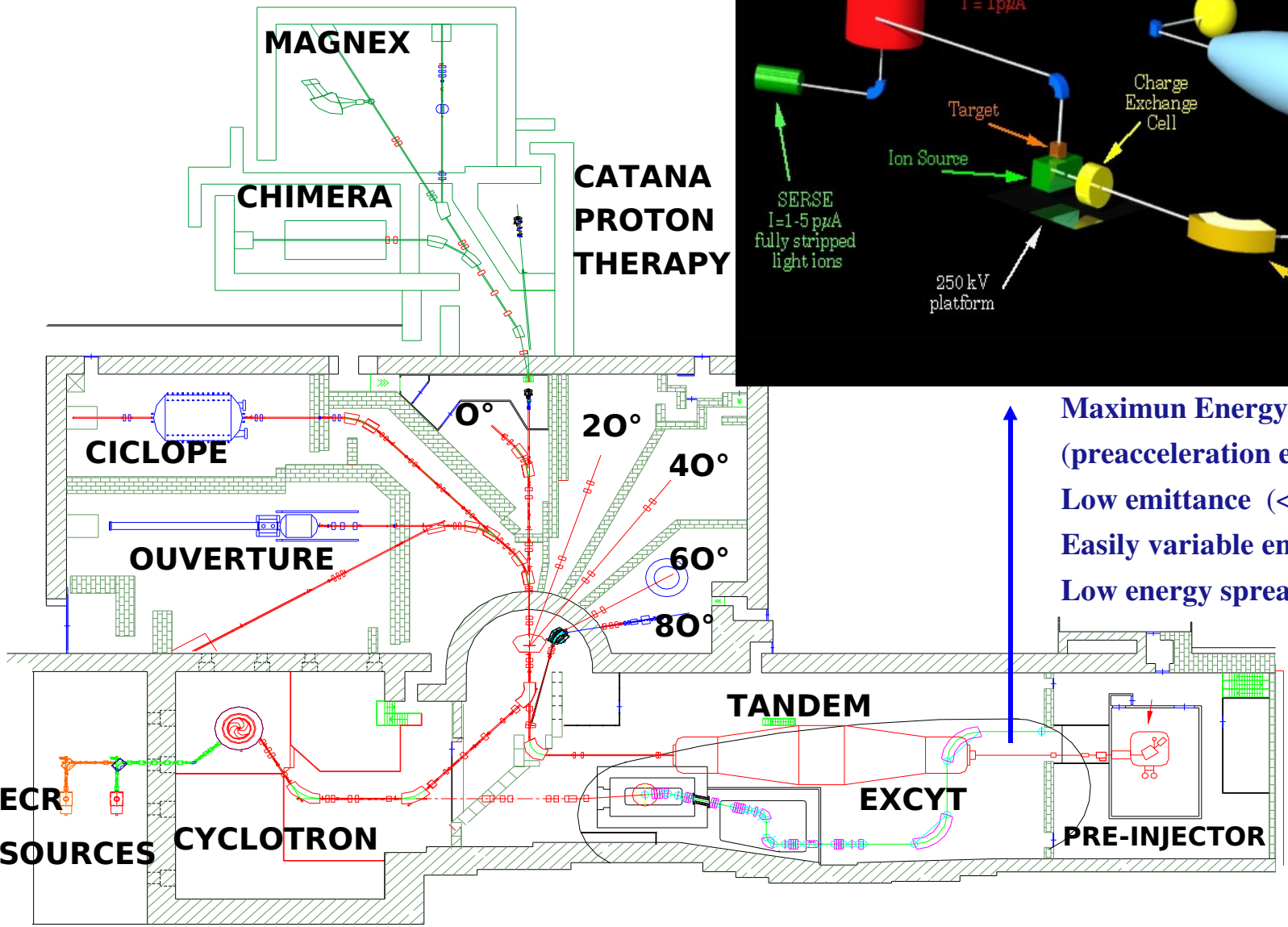
light ions



Bending limit	K=800
Focusing limit	Kfoc=200
Pole radius	90 cm
Yoke outer radius	190.3 cm
Yoke full height	286 cm
Min-Max field Tesla	2.2-4.8
Sectors	3
RF range	15-48 MHz

The EXCYT facility for radioactive beams





Maximun Energy: ~ 120 MeV
(preacceleration energy 300 keV)
Low emittance (<5 π mm.mrad)
Easily variable energy
Low energy spread: $\Delta E/E = 10^{-4}$

LANDIS

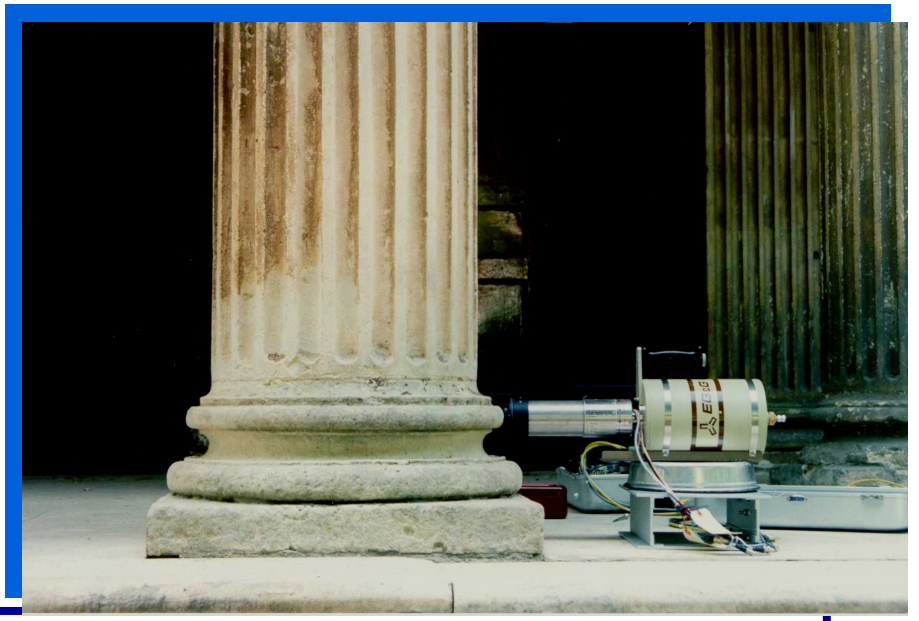
The laboratory of non destructive analysis of the LNS/INFN

THE FIRST PORTABLE PIXE-α SYSTEM

LICENCE CEA/INFN N° 9807435

The source was realised by electro-deposition of ^{210}Po on a thin silver film. The source was sealed and was certified as non contaminant.

The energy of the outcoming α particles is about 4.5 MeV.

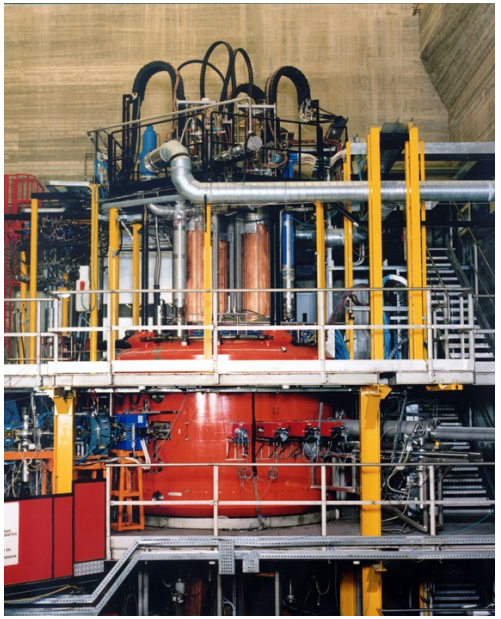


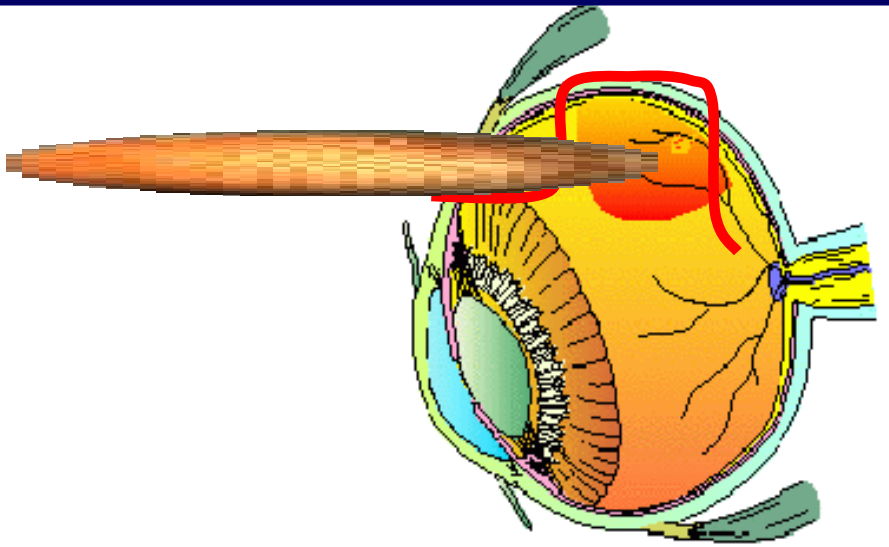
The in-situ analysis of samples in the cultural heritage field has been up to now very successful and will continue in the future.

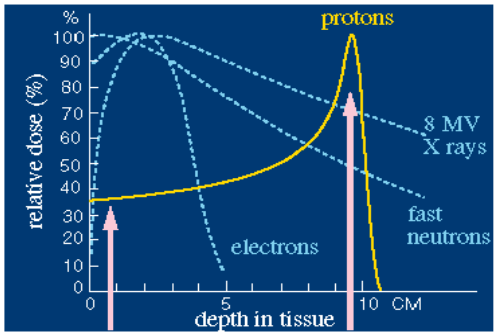
Present important goal:

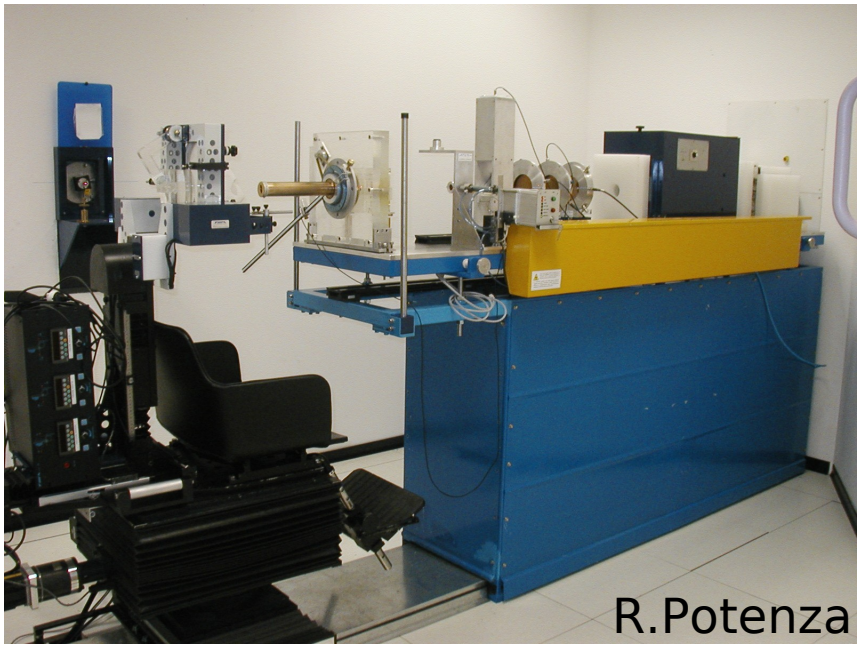
The Archaeological Museum of Misurata (Libia) for the characterization of the "Misurata treasure" (110000 Roman Age silver-plated coins)

CATANA : a facility for proton therapy treatment of the eye tumors







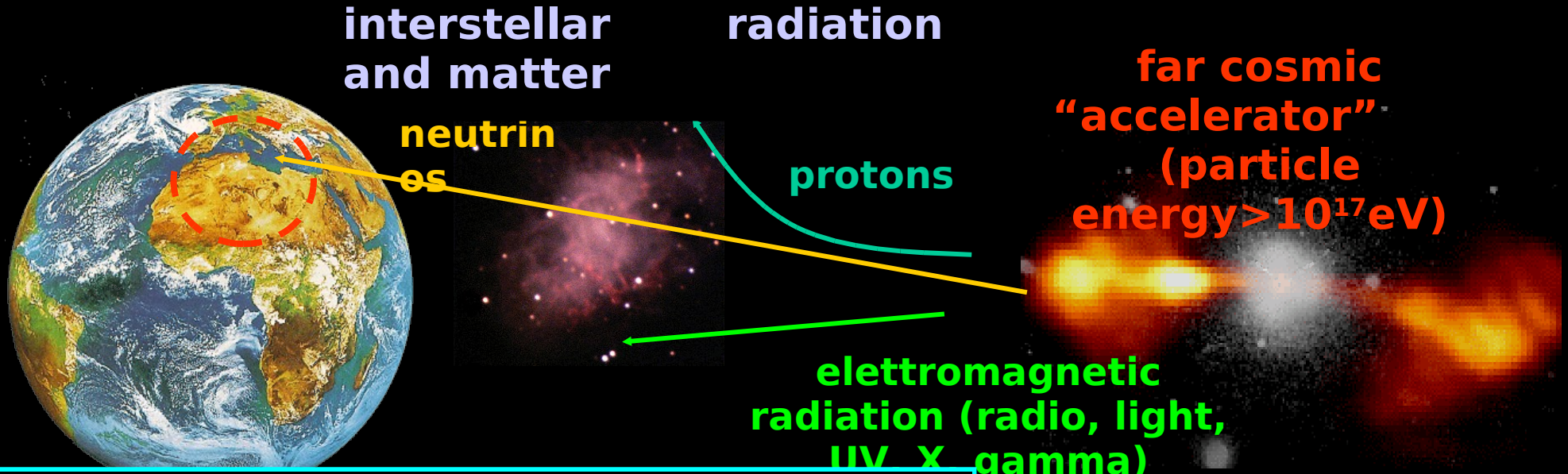


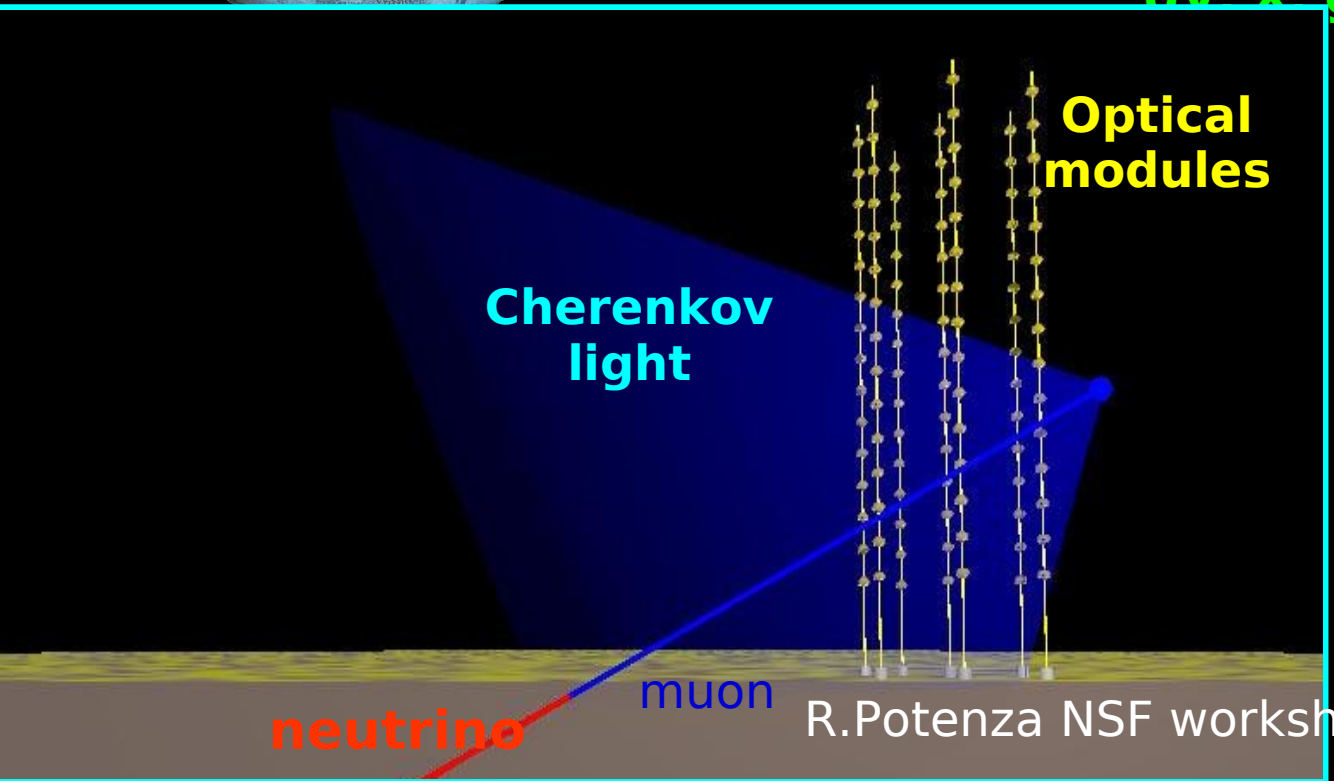
Proton therapy beam time

2002:	750 hours	23 patients
2003:	600 hours	34 patients
2004:	350 hours	19 patients
2005:	420 hours	16 patients
2006:	492 hours	31 patients
2007:	197 hours	18 patients

Total : 141 patients

High energy astrophysics





"Submarine Telescope" for very high energy neutrinos

It will allow to explore regions and phenomena in the Universe never observed so far.

Measurements of nuclear matrix elements *relevant for neutrino mass expected from double beta decay lifetimes* using suitable nuclear reactions

Particle spectra near 0 deg through diamond detectors (no magnetic spectrometers)

Detectors based on polycristalline or monocristalline CVD diamonds show today good energy resolution and will be tried to use to detect heavy ions near 0 deg due to their radiation hardness

MAGNEX

Main elements

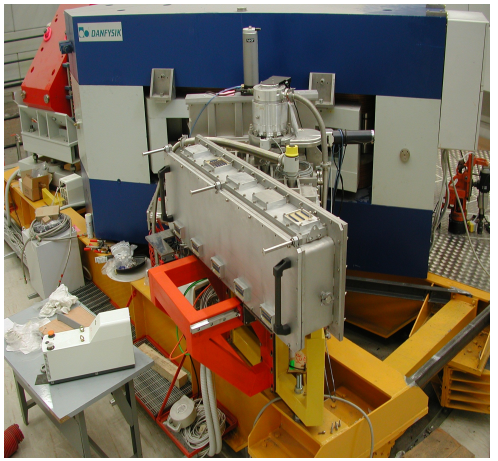
Position sensitive MCP start detector;

- **vertically focusing quadrupole;**
- **bending magnet;**
- **focal plane detector measuring ion direction, energy, charge and**

The start detector

PSD based on microchannel plate technology

The Focal Plane Detector



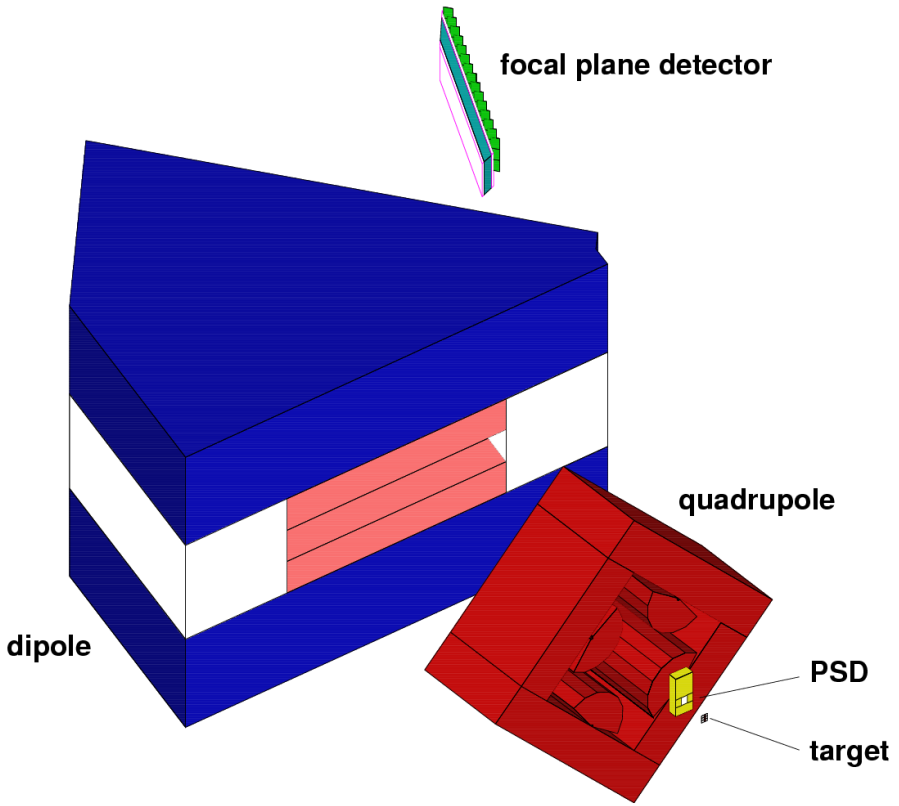
The FPD, realized in collaboration with GANIL, is ready and mounted on the apparatus.

Hardware minimisation for MAGNEX

- **Rotation of focal plane detector of 59°**
- **8th order polinomyal shaping of dipole boundaries**
- **Introduction of surface coils in the dipole pole tips**

R.Potenza NSF workshop
Washington, DC, Nov.2-4,2007

MAGNEX



Maximum magnetic rigidity	**1.8 T•m**
Solid angle	**51 msr**
E_{max}/E_{min}	**1.5**
Total energy resolution (target 1 mm²) (90% of full acceptance)	**~ 1/1000**
Mass resolution	**1/250**

Upper bent limits

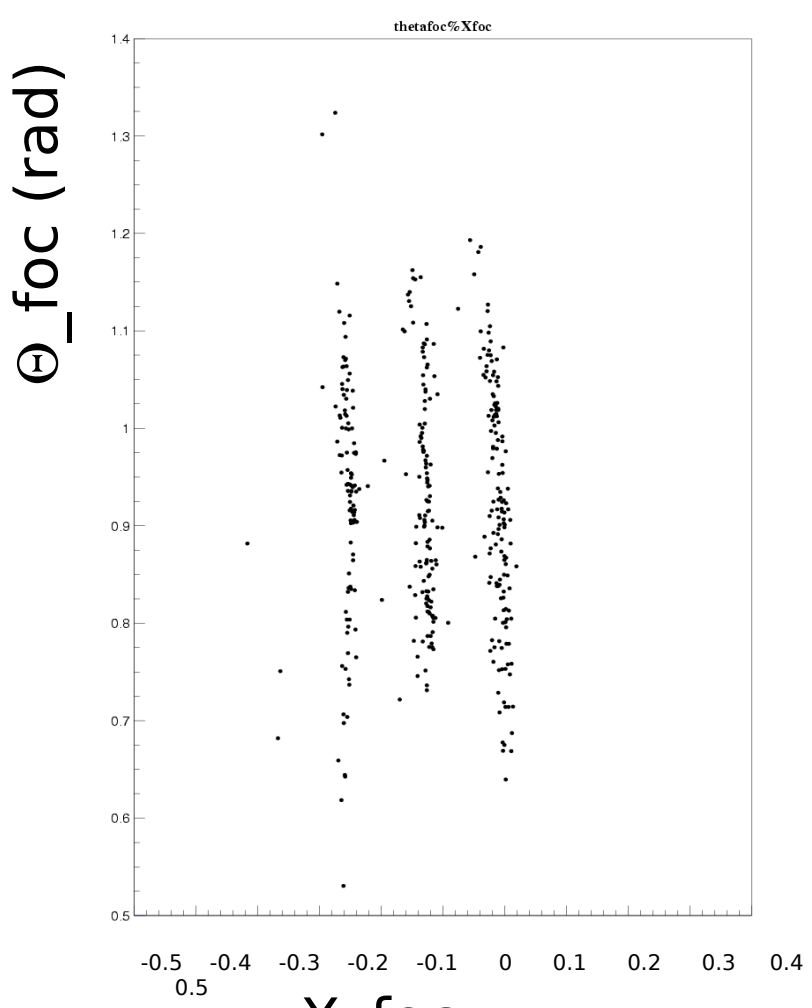
E <30 AMeV	**E < 25 AMeV**
2 < A < 40	**40 < A < 93**

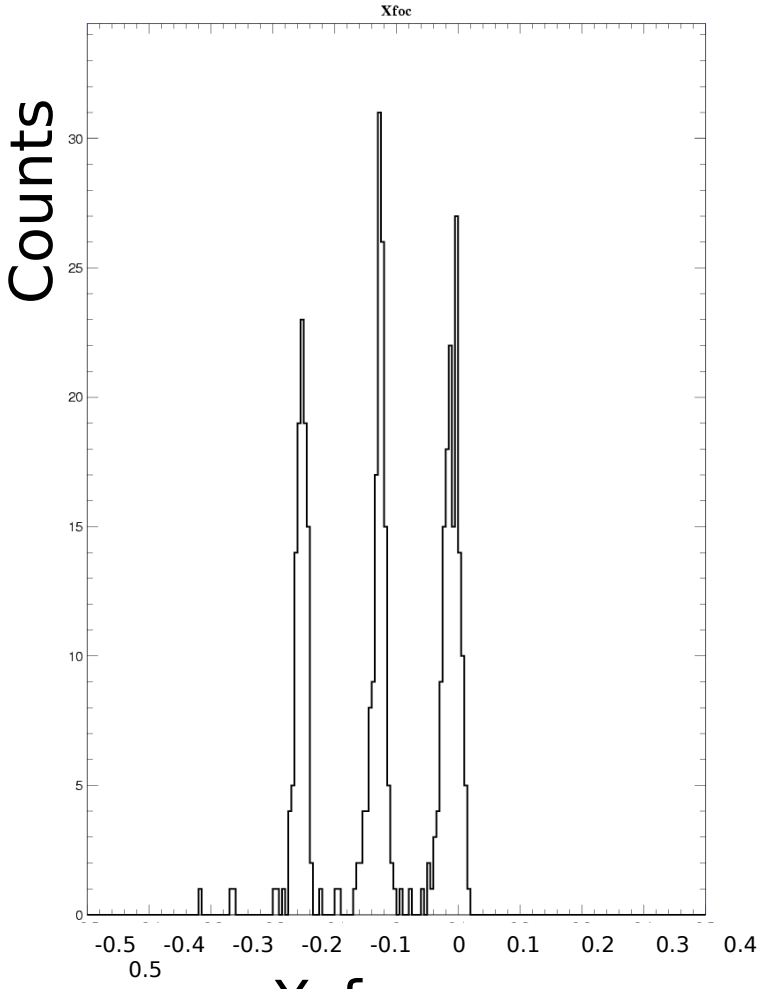
A.Cunsolo et al., NIMA 481 (2002) 48

A.Cunsolo et al., NIMA 484 (2002) 56

Alpha source at the target-object point

MAGNEX in large acceptance mode





Experimental lines

- **Complete the commissioning of the spectrometer with known *reactions like (^{7}Li,^{7}Be) with Tandem beams***
- **Experiments with EXCYT RIB's**
- **Spectroscopic studies of heavy ions via (p,t) direct 2n pick-up and via (^{6}Li,d) α-transfer**
- **Experiments of nuclear astrophysics (Trojan Horse Method)**
- ***Experiments with quasi stable (e.g. ^{14}C and tritium) Tandem beams***
- **Experiments with the LNS K800 Superconducting Cyclotron beams (e.g. pionic fusion)**